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# FOUNDRY TRADE JOURNAL

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FOUNDRY TRADE JOURNAL
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Vol. 70 Thursday, July 29, 1943 No. 1406

## Architectural Vitreous Enamel

Practically the whole of the March issue of "The Enamelist," the house organ of the Ferro Enamel Corporation of Cleveland, Ohio, is devoted to what has been accomplished in America in the field of the application of vitreous enamelled sheets in the building industry and its prospects for the future. There are two major aspects; one is purely utilitarian and the second largely decorative. The former consists of the replacement of roofing material—slates, tiles, asbestos sheeting, galvanised iron and the like—by enamelled sheets. The second is much more ambitious and relates to the actual facing of buildings. Apparently in the States this latter business has reached sizeable proportions and some 21,741 buildings have been so treated. A third aspect is the use of enamelled ware for internal construction, such as lift cages, wall partitions and wainscoting. It is interesting to note that, apparently for interior work, one advertiser gives a 25-year guarantee against "crazing, cracking and fading." Whilst this type of application has apparently but little interest for the iron-founder, the more extensive use of enamelled sheets by architects would have beneficial results, as, once confidence in the material is established, the profession would rapidly extend its use to other fields involving cast iron. It is to be deplored that when the largest company in Great Britain made a full-scale experiment on the surfacing of a building with vitreous enamel sheets, the results were "nothing to write home about." This poor start has to be lived down and a fresh one made, and propaganda—duly given a British bias—on the lines disclosed by "The Enamelist" would do much to neutralise the poor impression so far received. On the other hand, for all internal work, the position is different and the extensive use of tiling in the Underground stations is in itself a good advertisement. One suggestion we like is the use of enamelled sheeting for office partitions instead of wood or lathe and plaster, as it is said they can be made sound proof. For introducing the use of vitreous enamel for the exterior surfacing of buildings, we suggest that an effort should be made to induce one of the great holiday resorts to try it out, as they are usually very enterprising, and visitors would take back the idea to their various home towns. Filling stations, too, show similar enterprise, and here quite good data as to "life," appearance and upkeep can be had from the States, where such treatment is now no novelty. The vitreous enamelling industry must also take cognisance of the purely utilitarian aspect of the use of vitreous enamelled sheets for building construction, and we suggest that a serious of practical tests should be carried out immediately showing the difference in heat transmission through steel sheets and plates and similar material when glass covered on one or both sides. As nails and the like cannot be driven into enamelled-ware partition walls, there is room for some invention which will enable the housewife or office boy to hang pictures or affix a calendar or notice. Information is also necessary of means for assembling enamelled sheets so as to prevent effectively any cracking of the surface around the attachments. Advertising signs have suffered badly in the past from lack of ingenuity. The dissemination of information as to the use of vitreous enamelled ware in the building industries is of paramount importance at the present time, as architects are, *force majeure*, on the lookout for new materials of construction owing to the changed conditions which the war has brought about. Speed of erection is a factor which is uppermost in their minds owing to the already urgent demands, and here, at least, the enamelling industry can offer a solution.

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# CORRESPONDENCE

## SURFACES OF CASTINGS

*To the Editor of* THE FOUNDRY TRADE JOURNAL.

SIR,—The leader on "Surface Finish" in your issue of June 17, combined with Mr. Kayser's article and Mr. Logan's subsequent letter, all point to the interest which foundrymen might take in the details of this subject. Most of the available testing devices are only applicable to small parts or to specimens removed from castings. There is room, however, for some simple method of enabling the technologists in various separated foundries in a given concern, and for founder and ultimate user, to be satisfied that they are talking the same language when discussing surface finish. An engineer calling at a works might form a superficial impression about its castings and report unfavourably upon them compared with those produced by some other foundry. At a later date the same observer when visiting the second foundry might be surprised how different its castings really looked from what he had believed.

To overcome discrepancies which might arise in this way, a device was prepared and adopted in the L.M.S. Works during 1940 which may be of interest. What are called Roughness Comparascopes were produced and distributed to the metallurgical assistants at the various L.M.S. foundries. The Comparascopes were 10 in. long by 1¼ in. and ½ in., and consisted of a brass casing with a window which covered five different standard cast surfaces each 1 in. by 1¼ in. The standard specimens ⅜ in. thick and lightly sandblasted and lacquered were prepared by casting bronze against five different types of sand mould. There was no difficulty in matching several series of specimens of various roughnesses and then standardising a selection of them on a Schmaltz surface finish tester. The scale adopted ran from standard No. 1, having a R.M.S. roughness value of about 500 micro-in. to No. 5 having irregularities represented by about 3,000 micro-in. It may be remarked that the tentative American standard for surface finish available when the Comparascopes were made suggested values of 4,000 to 63,000 micro-in. as the range for rough castings.

It was found that the Comparascopes were easy to use in practice for either bronze, iron or steel, by holding them against the specimen to be judged, and reporting the standard number which most nearly matched. They provided an incentive towards the production of castings with a superior finish such as are needed for carriage fittings. A bad surface is definitely objectionable if it leads to increased cost of machining, or of buffing when the article has a decorative value and may need to be electroplated.

The present writer would personally be prepared to tolerate "austerity" surfaces on wartime sand castings unless there is some definite technical reason for demanding a very smooth finish. In the unmachined condition they are seldom employed in service to carry high tensile alternating stresses, so that surface condition is then a secondary consideration. Major foundry defects such as "sand holes" can never be allowed, but otherwise a wastage of time, sand and blackings may well be involved in procuring results which have æsthetic rather than engineering importance.—I am, Sir, yours, etc.,

HUGH O'NEILL.

Derby.
July 12, 1943.

## QUALITY CONTROL

*To the Editor of the* FOUNDRY TRADE JOURNAL.

SIR,—I think Mr. Warrington has made things quite clear in his Paper regarding the submittal note form, which I think is worth following up. I quite agree that a casting that undergoes a dimensional check after being radiographed, etc., and proved to be a good and sound casting should be recorded and filed away for production purposes. I am sure this method saves both time and money. I myself thank Mr. Warrington for the knowledge gained from the above Paper, and I am sure everyone that has read it is in agreement.—Yours, etc.,

A. E. LENG.

889, Barnsley Road, Sheffield, 5.

# NEW PUBLICATION

**Heat-Treatment of the Wrought Aluminium Alloys: Part II.** Equipment. Published by the Wrought Light Alloys Development Association, Union Chambers, 63, Temple Row, Birmingham, 2, as Information Bulletin No. 4.—This rather unusual but nevertheless exceedingly useful subject has been hitherto neglected by technical, research and development associations. The method of presentation, however, can serve as a model for the future, for by this means the works executive can reinforce appeals for better plant to the administration, for the latter like to have the satisfaction of originating developments, and will in most cases have the first opportunity of examining the bulletin. Moreover, the designers of plant gain useful hints as to modern trends, whilst the user is given valuable information as to care in installation and operation. The subjects covered are in the main salt baths, air furnaces, and temperature control. Seldom has any development association issued a more useful report than the one under review, and those of our readers working in the heat-treatment department should write to the director at Birmingham to ascertain whether any copies are left for general distribution.

MR. W. MACHIN, M.B.E., of Vickers-Armstrongs, Limited, Barrow-in-Furness, died on Friday last, July 23. He was an active member of the Lancashire Branch of the Institute of British Foundrymen, to which he was elected in 1932. Mr. Machin was the author of many Papers before different Branches of the Institute, and was the recipient of a diploma. He made valuable contributions, *inter alia*, to the metallurgy and founding of the silicon bronzes, etc.

# A METHOD OF CORRELATING FOUNDRY PRACTICE AND QUALITY OF LIGHT ALLOY CASTINGS

*Paper presented at the Fortieth Annual Conference of the Institute of British Foundrymen*

By H. G. WARRINGTON (Member), Production Metallurgist, High Duty Alloys, Limited

## I—INTRODUCTION

Many interesting Papers have been presented on foundry control, and many others describe the moulding methods that have been evolved to overcome the difficulties encountered in making a particularly troublesome casting. In a modern foundry laid out for mass production of light alloy aero-engine castings a preliminary investigation of the methods to be employed is essential, in order that satisfactory castings

FIG. 1.—No. 3573.

are produced with the minimum of wasters. In a jobbing foundry this is more than ever essential, where the number of patterns in use is greater per unit of floor area, and the possibility of small numbers off a greater variety of types means that the time that can be spent experimenting with moulding methods must be cut to a minimum.

In a foundry, moreover, that is closely associated with alloy developments, castings are often required for prototype engines and aircraft, perhaps only two or three off in a desperate hurry. They may be forgotten for perhaps six months, and then after tests are completed, not only are production orders received, but are divided amongst two or three other foundries in the country who require ingot material of the alloy originally specified, and welcome some assistance as to the moulding methods that will get the job under way as quickly as possible. It is incumbent on the supplier of ingots to specification to be in a position to recommend casting practice and to be able to take on any job at a moment's notice.

With this problem to face it is evident, first, that a routine must be established for recording moulding methods so that a casting can be picked up again after a lapse of time, and recommendations made in a clear manner to other foundries, and, secondly, that a rapid means of examination is conducted, and what is more important that the results of the examination are transmitted to the foundry in the case of an unsuccessful first attempt so that the correct modifications can be adopted to produce a sound casting next time.

### Following-up in Production

A third factor which must on no account be overlooked is the importance of checking the production run as well as the first few samples. The early castings are usually produced under the eye of the foreman moulder, the metal temperature check, fluxing, degassing and grain refining if called for, conducted by a laboratory worker, and the heat-treatment given special priority. Under these conditions a perfect casting can be produced by a method that is not flexible enough for later production, and it is obviously more practicable to provide a foolproof method than to tighten down on detail to the extent that one is always working near the danger line.

Similarly a further examination is required in detail with a follow-up in the case of any change in procedure that may be necessitated in the course of production. An example may be given of the results of changing an aero-engine cylinder head from floor to machine moulding. The machine method meant elimination of sprigs between the fins, and the substitution of oil-bonded silica sand for natural bonding sand. Otherwise the methods were identical, but sections cut through the machine-moulded castings demonstrated that a hot spot had developed exactly opposite the runner gate, causing a shrinkage cavity, which was just hidden from superficial inspection by a skin of sound metal. Observation showed that the solidification period with the altered sand was considerably longer, with the result that whilst risering

## Quality Control in the Foundry

was still adequate a new method of gating had to be developed before machine moulding could proceed.

The accumulated knowledge of these recorded effects of various moulding methods can lead to later changes in production, even if proceeding satisfactorily, as reflection on the first examination and the later follow-up may frequently indicate where a change can be introduced, not necessarily to improve the quality of the castings, which was the initial object, but to reduce the man-hours employed in moulding, coremaking or fettling. Such modifications, however, on aircraft castings subject to radiological examination and usually highly stressed are of necessity a secondary consideration, and the first object must always be to obtain a sound and uniform component.

FIG. 2.—No. 3652.

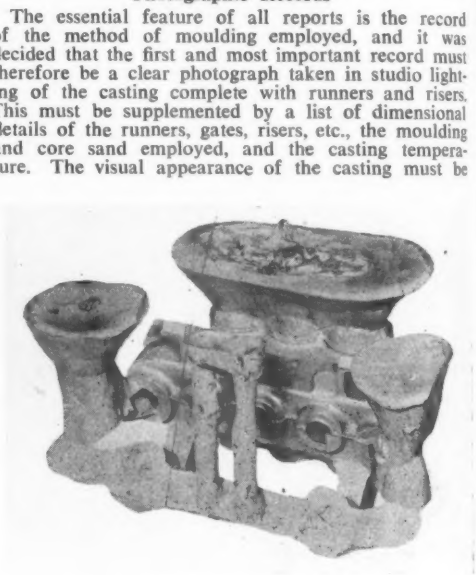

FIG. 3.—No. 3653.

### II.—EXAMINATION OF "FIRST OFF" CASTINGS

The first casting made is invariably used for dimensional check, and in all foundries there is, or should be, well established machinery for transmitting this information to the pattern shop, initiating modifications and recording departures from drawing. Slight variations from dimensional tolerances do not often affect the moulding methods, however, and for the control system described it is convenient to make two castings from the first pour, the second one being sent to the laboratory for control check. The completeness of this investigation will depend on a number of factors, such as the size and intricacy, design stressing, number required, and previous experience on similar types of casting in the alloy employed.

A full investigation will seldom be necessary, and indeed as a routine check, to be conducted with the precision of check tensile testing or dimensional inspection, its main advantage would be lost if too much time were employed getting down to unnecessary detail which might delay getting important features back to the foundry in time to control the first production run. The examples given later, therefore, whilst showing certain features in common, will vary in the method of evaluation, particularly on first check, with the importance of the casting.

#### Photographic Records

The essential feature of all reports is the record of the method of moulding employed, and it was decided that the first and most important record must therefore be a clear photograph taken in studio lighting of the casting complete with runners and risers. This must be supplemented by a list of dimensional details of the runners, gates, risers, etc., the moulding and core sand employed, and the casting temperature. The visual appearance of the casting must be described in all cases, but the remainder of the examination will vary with expediency. To locate internal shrinkage, porosity, grain size variations and segregation, use may be made of radiography, polished and etched sections, fracturing and pressure tests.

To evaluate stress requirements and general homogeneity, tensile test-pieces may be taken from a number of locations, and in the case of large piston castings a Brinell hardness survey is taken on all machined surfaces. These can be itemised as follows:—(1) "First off" castings, one to dimensional check, one to quality check; (2) photograph showing runners and risers; (3) record of dimensions of runners and risers; (4) details of moulding sand, core sand, pouring temperature, etc.; (5) visual examination; (6) radiological examination; (7) heat treat, if required; (8) fracture examination (essential for heat-treated magnesium-base alloys); (9) macro and micro examination of typical sections, face polished and etched; (10) tensile tests

from representative sections (stressed castings); (11) Brinell hardness survey (piston castings); (12) pressure test (after machining if possible); (13) analysis check for composition variations.

The completion of an investigation of this nature would delay castings urgently required, and sufficient information to enable the foundry to proceed can normally be given after radiological examination has been completed. This is achieved by means of an interim memorandum sent from the laboratory to the foundry superintendent approving the method for production or notifying the necessity for modifications, with descriptions of the defects encountered. In this way the necessity for an individual report for each modification is unnecessary, the investigation being held over until another casting is available, so that the official record will normally describe the satisfactory method, and finish with the formal approval for production.

On many simple components it is simply necessary to report that "the casting has been photographed, examined visually, radiographed and fractured. No defects were noted and the method is approved for production." This assumes, of course, that it is of a type that has a good previous history, and that from knowledge of similar components in production the examiner is confident that no difficulties such as distortion or cracking will occur during heat-treatment, and that from his knowledge of the alloy concerned and of the customers' requirements that there will be no doubt that the required mechanical properties will be achieved. This is no mere assumption, and links up the "first off" examination with another type of investigation that is conducted from time to time.

When a new type of alloy is introduced into the foundry, before production castings are made, an assortment of typical patterns are chosen, whose reactions to standard alloys by established moulding methods are known, and a few castings of each are made. If these are successful, or achieve success after modifications to suit the new material, it is then known that for certain general types of moulding castings will be expected to have certain mechanical properties.

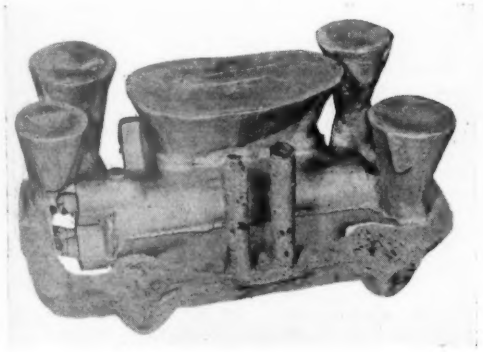

FIG. 4.—No. 3654.

## III—SUBMISSION OF CASTINGS

The mechanism by which the casting is submitted for examination may be varied to suit local conditions. It may be established that when the dimensional check is made, the inspection department require two castings, only one of which is to be fettled, and the other they will record after a rapid visual survey and pass on to the laboratory for the major investigation. This will ensure that obvious defects such as draws, cold shuts or crushes are not submitted, but has the disadvantage of breaking the contact between laboratory and foundry.

FIG. 5.—No. 3662.

Another method is for the laboratory man who is responsible for quality control in the foundry to have access to the production department's list of requirements for new castings, and arrange to be present once or twice during the moulding, and, when the casting is poured, noting all relevant details. He can then discuss the moulding and the apparent results on the spot, and take the casting away for testing. A cast-iron ruling should not be made on this point, however, as on a number of new jobs a glance at the pattern will indicate that the examination will merely be a formality and that production can go straight ahead from the moment it is received in the foundry, the inspection department merely making sure that nothing is despatched to the customer until

## Quality Control in the Foundry

the result of the examination is known.

It is obviously important that this decision must be taken wherever possible, not only to avoid the development of an irksome system for stopping good men working, but to develop a spirit of collaboration between the laboratory man and the foundry, and to allow the foremen and technical people freedom from an insistence on a routine to put their mutual efforts into consideration of the more difficult jobs where a cautious approach is necessary if valuable man-hours are not to be wasted moulding up for production of expensive scrap.

### Progressing and Records

An important formality, however, that was found to be very necessary is the recording and progressing of each examination by means of a "Submittal Note," a copy of which is shown. There are several

FIG. 6.—No. 3801.

items printed on this form irrelevant to the examination of castings, so that it can be used as a universal record for submission of forgings, sections, sheet, etc., from production or customers' complaints or requests for special tests. The form is divided into three parts, one being kept by the department submitting the job, one containing the instructions in the case of special types of investigation, which accompanies the job to the laboratory and is attached to the manuscript of the report, and one which is filed in the laboratory administrative offices.

Each part, separated by perforations, is printed with the same serial number for correlation and reference. The form then ensures that there is no doubt, when a casting has been submitted from the foundry, that the volume of work and time taken on the investigations are available, and that an unreasonable delay does not occur between submission and report without some inquiry being made. Each report is also given a serial number, and the method of casting is identified by this number in all works' correspondence. It is obviously simpler to refer to "method No. 2569," for example, than to say, "the method used for machine moulded cylinder heads, Part No. —, prior to our latest modification," and also avoids any possibility of error.

---

SUBMITTAL NOTE FORM

SAMPLE TO LABORATORY FOR INVESTIGATION

*All Samples to be sent to Laboratory Stores.*

No. .....

Will you please investigate and report on the following material:

Customer .....
Component .....
Part No. .....
Alloy .....
Melt No. .....
Reason for submission .....
No. involved in complaint.....
Reference letter dated .....

Signed ..... Dated.....

The above details to be filled in by Department submitting material.*

---

No. .....

To: Mr.....

From: Mr. A.

Will you please examine and report on the above samples, the investigation to include:

| | |
|---|---|
| Chemical Analysis. | Investigation completed: |
| Microscopical Examination. | ..... |
| Macro Examination. | |
| Grain Flow. | TIME BOOKED |
| Brinell Hardness | Name ..... |
| Corrosion. | Hours ..... |
| X-ray Examination. | Draft Received ..... |
| Fracture. | Passed to Typists ..... |
| Approval for Production. | Received from Typists .... |
| Please delete investigation not required. | Report No. ..... |

To Mr. B. No. .....

From: Mr. A.

Will you please progress this work which has been passed to Mr. .....

CUSTOMER COMPONENT

Sample Received by Laboratory Nos..... No. .....

For information please ring Mr. B. Phone *xyz*.

Signed .....

Date .....

THIS PORTION TO BE RETURNED TO DEPARTMENT SUBMITTING MATERIAL.

Copies of the reports are issued to the foundry, the inspection department and the management, and filed in the laboratory. A list of titles and references is circulated generally to all others who are likely to be interested and who can obtain copies on demand.

## IV—TYPICAL INVESTIGATIONS

### Example 1

The first example chosen is of a magnesium alloy casting which involved particularly stringent pressure test requirements, and owing to the amount of machining to be an almost perfect casting. A large number of attempts were made before successful castings were produced with low rejections, but a certain amount of production was carried on during the experimental series.

*A Report on the Examination of a Number of Sand Castings to Part No. — for Messrs. —— in M.A. 181 to Specification DTD.59A*

*General.*—Castings from several different methods of manufacture were submitted for laboratory examination and approval of the best method of manufacture and foundry technique. The castings were examined visually, photographed, heat-treated, radiographed and fractured for examination. The various methods of manufacture are illustrated by the attached photographs, Figs. 1-6. Below is a summary of the observations made upon examination of the castings.

*Fig.* 1.—Several castings were made by the method illustrated, but each succeeding casting incorporated slight modifications to the previous sample. In the first sample examined, several areas of shrinkage were apparent, particularly in the thick wall of the tube beneath the top riser and also in front of the riser at the back of the casting. This riser was omitted from all further castings without affecting the condition of the castings in general. In an attempt to overcome the shrinkage beneath the top riser, chills were placed in the cores, but the defect was only displaced and not eliminated. Further samples were made in which the top riser was given an asbestos liner. This is illustrated by Fig. 2, which is a photograph of a casting without the back riser.

*Fig.* 3.—In an attempt to eliminate the shrinkage beneath the bosses observed in previous castings, the casting was inverted, all details of running remaining the same as before. This modification produced little change in the severity of the defect in the affected area, whilst a further region of shrinkage developed in the bosses beneath the top riser. This modification was abandoned.

*Fig.* 4.—Another sample was made using the same running system as before, with the provision of additional gates, in an attempt to fill the mould more quickly and allow the top riser to function properly. Some improvement was evident, but the casting was still below a satisfactory standard for production to proceed.

*Fig.* 5.—At the risk of excessive turbulence in the mould, it was decided to "top run" the casting, the runner being gated into the top riser. An open top mould was employed, whilst steel wool filters were used in an attempt to check the flow of metal and minimise dross inclusions. Samples with one, two and three gates to the riser were produced, the most satisfactory results being obtained from the double-gated casting, which is illustrated by Fig. 5. A few production castings were made, but numerous rejections occurred due to dross inclusions.

*Fig.* 6.—The practice of "top running" the casting was discontinued and further samples submitted for examination in which horn gates to the bottom of the casting were employed, together with a large top riser. The gates were situated at the lugs in one sample, and at the end of the walls of the cylindrical bosses in the other. The latter sample gave the more satisfactory results of the two, and is illustrated by Fig. 6. Rejections on pressure testing of castings made by this method have not exceeded 2 per cent.

*Conclusion.*—Castings to this part number may be regarded as satisfactory for production to proceed using the method illustrated by Fig. 6. *Dimensional Details:*—(1) Downright, $\frac{7}{8}$ in. dia.; (2) channel, $1\frac{1}{4}$ in. by $1\frac{1}{4}$ in.; (3) horn gates, $\frac{7}{8}$ in., tapering to $\frac{5}{8}$ in. sq.; (4) riser, 9 in. by $5\frac{1}{2}$ in. top, $1\frac{1}{4}$ in. by 6 in. base, $3\frac{1}{2}$ in. high. The mould was made in Bedford silica sand plus ammonium bifluoride inhibitor, and the cores in Bedford silica sand bonded with Crulin B plus ammonium bifluoride inhibitor.

(*To be continued.*)

## INDUSTRY AND EDUCATION

(*Concluded from page* 265.)

The foundry must be publicised and advertised, as has been suggested for industry in general. The Institute of British Foundrymen, already the centre of external activities connected with the foundry, can do much to recommend the trade; by lectures and films, illustrating the more modern foundries, in schools, technical colleges, etc.; by compiling the advantages and opportunities, with the qualifications and responsibilities attached to the varying grades of employment, in the trade and by supplying, possibly in leaflet form, this information to the education authorities and panels, together with lists of foundries suitable for works visits by students.

Finally, the authors may have said nothing that is new and probably much that may be dismissed as impossible, especially until this war is over. The answer is:—(1) A plan made now can be modified after the war to suit prevailing conditions then, and if a framework is built now, then the initial inertia has been overcome; so much more progressive than leaving till to-morrow the problem of to-day. (2) Industry has voiced a complaint and the causes of that complaint will continue to exist until some of these "impossible" alterations are made.

**Acknowledgments**

The authors wish to record their grateful thanks to the many colleagues who, by provision of data and patient discussion, have assisted in the preparation of this Paper.

## PATTERNMAKING WRINKLES—XII

By "CHIP"

When timber is required of greater width than that in stock two or more boards have to be joined together. This is accomplished in a variety of ways. Fig. 1 shows timber of approximately 1¼ in. thickness joined by a glued joint and a screw dowel. This useful expedient is shown in Fig. 2, and is virtually a double-ended screw. The method of forming a joint is to prepare two pieces as A and B (Fig. 3) with the edges C and D true with a given face. A gauge line is then

FIG. 1.


FIG. 2.


FIG. 3.

FIG. 4.

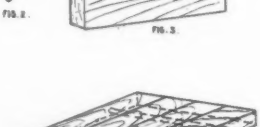
FIG. 5.

made from this face approximately half the thickness, and a centre line squared over. Holes are bored in the centres thus made, and a screw dowel inserted in the piece of timber B, which is held in a vice. Piece of timber A is then placed over the screw dowel and turned around over it until pulled up tight. Before the final pull a thin layer of hot glue is spread over the joint, and the top part is then pulled up tight and clamped on the ends and left to dry. Alternatively iron or wood pins or dowels as X.X. (Fig. 4) may be used.

For timber of between 2 and 3 in. thick bolts are often used, as illustrated in Fig. 5. For this method all joints are carefully made and holes bored through to receive the bolts. The end being recessed in the outside piece box spanners are necessary to tighten, and the holes are subsequently plugged. Some shops are fortunate enough to obtain timber of considerable width, and thus are not so frequently called upon to join up timber as those shops only using timber of 11 in. width.

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**Remelting Aluminium Patterns.**—Any American foundry may now remelt aluminium scrap in the form of obsolete or defective patterns furnished by the prospective purchaser of the new pattern without prior authorisation, the War Production Board has ruled. Wherever possible, old patterns should be used to make new patterns, the direction said. Patterns, as defined in the direction, means only match plates, patterns, core-boxes, core driers, and snap flasks made of aluminium.

## POURING TIMES IN CASTING

The longest period for pouring a casting of specific shape and dimensions is determined by the temperature of the metal, its form-filling ability, the need for ensuring a certain rate of rise for the cast iron, the capacities of the furnaces and ladles, and the necessity of maintaining thermal uniformity throughout the casting, points out an article in "Usine belge." Formulæ for the pouring time have been deduced by H. W. Dietert, J. Varlet, Audo, I. Lamoureux, Miakowski, and others. In the case of castings with very thick or very thin walls, special considerations apply. The cross-section of the ingate is determined by the pouring time, the weight of the casting and the pouring factor, these depending on the quality of iron used. In the formula $S = P/T.d$; S is the cross-section in sq. cm., P the weight of the casting in kg., T the time of pouring in secs., and $d$ the pouring factor, which is 1.5 for iron with 0.5 per cent. P, 1.4 for hematite, and 1.2 kg. per sq. cm. per sec. for low-carbon iron.

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## SCIENTIFIC PHOTOGRAPHY

In recent years there has been a very marked increase in the use of photography as a scientific instrument in applied science and industry. It is felt that the majority of workers in these fields are working quite independently of others similarly engaged and that a new organisation catering for their special photographic requirements would be of considerable value. An Association for Scientific Photography has accordingly been formed, membership of which is open to any person actively engaged or interested in the use of kinematography or photography as a scientific instrument. The aim of the Association is not only to promote interest in the use of photography in all branches of science, technology, and medicine, but also to assist its members in applying photographic methods to the solution of particular problems. The Association proposes to establish what might be termed an information bureau containing, as far as possible, full particulars of the activities of all members and, in suitable cases, the existence and whereabouts of specialised photographic apparatus and equipment. The Organising Secretary is Mr. R. McV. Weston, "Houndwood," Farley, Salisbury, Wilts.

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**Women in the American Foundry Industry.**—Employment of women in the American foundry industry will increase materially this summer and autumn, Miss Sara Southall, of the International Harvester Company of Chicago, and the War Man-power Commission, told the American Foundrymen's Association at a recent meeting. Those who are now employing women will use more of them, she said, and foundries who do not employ them at present will do so on an ever-increasing scale. Foundries, steel mills and shipyards are the most difficult jobs women can take. However, they are doing it, and 80 per cent. to 90 per cent. of them will return to their homes after the war; this is the result of a recent check, she said.

# INDUSTRY AND EDUCATION

By G. L. HARBACH (Member) and J. R. HORTON (Associate Member)

*Paper presented at the recent Annual Conference of the Institute of British Foundrymen*

## PART I.—PREPARATORY EDUCATION

Children leaving school are no longer satisfying the needs of industry and, for two main reasons, the latter has had increasing cause for complaint. First, there is a definite numerical shortage of recruits, as in the textile and foundry trades; secondly, industry as a whole is critical of the standard of education, to be found amongst both elementary and secondary school apprentices and beginners. The present war and the decline in the birth rate have both intensified the causes for complaint, but cannot be held as the initial reason for such a state of affairs. The fact that boys do avoid certain trades, causing a dearth of apprentices therein, means that their outlook has been so formed that they prefer some other occupation; either because it is more agreeable to them, or because they have been led to believe it will be so. The dissatisfaction of industry in general with the ability of the boys expresses some lack in their training prior to entering industry.

Now, the Board of Education contemplates drastic reform of the educational system, the main points of which are stressed as equality of opportunity for higher education, including financial compensation where necessary; raising the school-leaving age to fifteen or sixteen years, and compulsory part-time education up to eighteen years of age. If this means merely an extension and widening of the present manner of education, then industry will receive no benefit from the reforms, and may experience a worsening of the situation now confronting it. To prevent such a happening there must be an alteration in the *kind*, as well as the extent, of the education to be received by the future worker; it is proposed to outline in this Paper a criticism and revision of the present systems, define their relation to industrial needs, and thereby stimulate a discussion to precede the action industry must take to safeguard its future well-being. Education has been so frequently discussed during the last twenty-five years that the authors cannot claim originality or a new conception of the subject; but it is hoped that a review of the salient features will remind members of the urgency of the situation and provide them with sufficient material for the above very necessary discussion.

### Past Aspects on Education

Education prior to 1750 was purely academic, and only modified during the next fifty years by the founding of private schools by the manufacturers, who desired a more practical education for their sons. This represents a striking parallel to the situation to-day. Technical education commenced about 1830 with the formation of the Mechanics' Institutes, but was neglected thereafter, in comparison with European countries, by reason of Britain's commercial and industrial pre-eminence during the nineteenth century. It will be realised that this superiority no longer exists to the same extent, and, after this war, will have dwindled still further. The early years of the twentieth century saw far-reaching reforms in elementary and secondary education, using as a basis the traditional, academic standards, with scholarship as the final aim and written examination to provide the test of quality.

Education has been regarded as an end in itself; the ability to earn a living, the qualities of citizenship and knowledge of commercial and industrial conditions, have been shelved as secondary to this end. However, some 550,000 elementary school children leave school each year; 10 per cent. of this number continue with secondary education, and the remainder find work. These last have received an education whose goal has been the passing of the secondary school scholarship examination—78 per cent. of secondary school children are ex-elementary products. The goal of the secondary education is the passing of the Higher Leaving Certificate, Matriculation or Bursary Competition Examinations for University—which in turn is the gateway to the professions, absorbing less than 2 per cent. of the working population. Therefore, broadly speaking, the education of 98 per cent. is subordinated to the ambitions and requirements of 2 per cent.

### Distribution of Entrants

Before analysing the changes that will rectify this unsatisfactory state of affairs, it would be as well to consider the proportions of children who will enter industry. Of approximately 20,000,000 workers, about 7,000,000 are employed in registered industrial occupations, including mining and quarrying. Of these, not more than 2,500,000 are in the types of industry which can be allied with founding and engineering—the foundry trade itself absorbs not more than 250,000. Therefore, we must not lose sight of the fact that our types of industry only claim some 13 per cent., and the foundry itself a mere 1.3 per cent. of the total working population. Thus, radically to alter the educational system for all, with an eye to the needs of industry alone, would once again be a short-sighted policy.

The present Minister of Education has proposed a segregation of children, at eleven years of age, into three groups, according to their future vocation, to wit:—(1) Academic and artistic; (2) black-coated workers; and (3) artisans. All education after this division to be classed as secondary. The authors consider eleven years of age is too early to make such

## Industry and Education

a definite decision and, if it should become law, then some provision must be made for easy transfer later from one group to another. Throughout this Paper it has been assumed, with reasons, that children up to eleven years will receive the same education; at eleven they will qualify for an education, for a minority, to be called secondary education, the remainder to receive what the authors will continue to call elementary education until they become of school-leaving age, and take a job.

### Early Education

The education of children up to eleven years of age is a problem in which industrial needs must be faded into a pattern, which will give the children a training for future life in general—a design for living. The narrower views of academic scholarship or vocational training for industry and commerce must not occupy a large portion of the curricula, except in so far as either help to further the broader aim of preparing the child for a useful existence. The substance of this instruction is outside the scope of this Paper, but the following points give the framework on which such a course could be built. As at present the brain must be encouraged to think, develop initiative, flexibility and adaptability. Explain that service of some kind or another will be the lot of 90 per cent. of people and that payment in money is not the whole value of service rendered. Abstract subjects can be made more real and understandable by clothing them in forms related to the things seen in actual life. Bring the classics into their proper perspective and concentrate on the correct spelling and writing of English, before instilling appreciation of classic authors. The reason for the different lessons should be explained—whys and wherefors—because the reason for a lesson may be more important than the actual subject matter. Emphasise that clean or dirty hands and clothes are not necessarily indicative of social position. In short, make the world about the child really live instead of leaving him to regard it as something that goes on outside the school walls.

At the age of eleven a competitive examination for secondary scholarship can be set as now, but based on the revised elementary course. It should not represent a criterion of the factual knowledge contained in eleven-year-old brains, but rather of general ability, designed to test the quickness and initiative of the brain with a view to absorbing further knowledge. Those who continue at elementary schools (unless at, say, thirteen years of age marked ability merits transfer to the secondary course) will be taking a job in four years' time and their studies should now lead towards that goal:—Practical mathematics, competence in handling figures and a knowledge of accounts, the mechanism of Government and social services, with discussion of the types of job the child may take, with particular reference to local trades and what they entail. Emphasis should be laid on practical subjects: wood and metal working, bricklaying, painting, decorating and plastering, gardening, general repair and maintenance, etc. Include such theoretical knowledge as will be useful to the child and make of him a budding handyman, so that, whether he becomes a clerk, 'bus-driver or foundry apprentice, his hands will have learned to co-ordinate with his brain, and he can apply some of his schooling in his new job. Also, he will have gained the basis for some hobby or spare-time occupation that will increase his value to himself, his home and the community at large, *i.e.*, he will have received some training for leisure.

During this time information should be afforded the school authorities of new trends in industry, the state of the labour market and of the advantages and amenities pertaining to any particular trade. An industrial career should be popularised and made attractive in the boys' eyes, just as are the Civil Service, banking, accountancy and architectural careers; many a boy enters these latter careers lured by descriptions of clean hands, short hours and good money, only to find he is unsuited in temperament, and the substance is changed into shadow.

To accomplish this aspect of education each industry, through its technical societies and associations, should form national committees to provide advice and recommendations to the Board of Education; regional committees should be formed from local societies to act in the same capacity with local education authorities. In peacetime the Ministry of Labour in each town has already sponsored a committee composed of representatives of the Chamber of Commerce, executive and operative branches of local industries and the local education authorities, to advise on the employment of youth. It cannot be too strongly stressed that parents, children and school authorities should possess knowledge of the conditions, prospects and vacancies in industry. Also, as one is chiefly interested in what confronts one most, encourage recruits by arranging for publicity and advertisement of industry in a non-technical manner—through the Press, films, lectures and wireless—to attract the attention of parents and children in the desired direction.

### Secondary Education

Secondary education should also follow the above lines, with the main difference that the final product must be able to enter a more varied field of occupation, in accordance with the extent and contrasts in the types of knowledge required. The academician, artist, professional, technical and administrative classes all lead from secondary education. None of these must lose touch with the realities of a competitive existence, but the degree of specialisation must be intensified and must involve a segregation of the boys according to the career they intend to follow. The choice of this career cannot be made without a conference between parents, teachers and children, bearing in mind evidence of the boy's particular bent and progress throughout elementary and secondary school.

For the first three years of secondary education all can follow a general course until this conference takes place. Then, at the age of fourteen, sufficient knowledge of the child's ability and tendencies should be available to allow him to commence the vocational stage of his training. It is not the object to turn out a finished article at seventeen years of age, capable of entering fully qualified into an industrial position, but it is desirable to produce a recruit who has absorbed the fundamentals underlying his position, and who will be able to continue his part-time and evening studies while keeping pace with his works' practice. This in contrast to the present-day student needing to concentrate unduly on the technique of a new job and often overloading the brain with studies at night-school.

### The Problem of Teachers

The teachers of the new system present a difficulty. At present they are of the "teacher" type—superannuated, socially secure, remote from industrial conditions or discipline—and teach with this outlook. As models for the academic or professional student they are ideal and produce excellent results from these types of student. By the same reasoning, other employments must be represented on teaching staffs by their particular experts. The future of this aspect will solve itself, because the students under the new system will furnish the types of teacher needed. In the meantime look to the ranks of industry and commerce to provide instructors during the transition period.

The technical schools have proved the standby in remedying the defects in industrial recruits. Their system needs little alteration beyond a revision of present curricula to match up with the elementary and secondary school products who will attend them. Overlapping nowadays is unavoidable because the two types of education have different aims. The new scheme endeavours to make these aims the same, and the overlap should disappear.

The educational purist strongly denounces vocational training as being utilitarian and divorced from true education. He fears an ultimate race of robots, bred and trained for the industrial machine. The materialistic industrialist pooh-poohs general education as unnecessary—teach the boy a trade, children will have to earn a living and their education should be subordinated to that end, if robots are the result, they will at least be efficient operatives. The proposed scheme steers a middle course between these two extremities and hopes to appease both.

### Example of H.M. Dockyard Schools

As a particular example of such training as has been envisaged, consider H.M. Dockyard Schools; founded 100 years ago and furnishing the craftsmen, designers, technicians and administratives for all variety of trades in the dockyards. An entrance examination not beyond the capacity of present elementary standards admits the boys at 15 to 17 years of age. Over a four-year course they attend lectures, given by professional teachers and qualified dockyard employees, for 12 hours per week, and cover a full-time engineering course. The rest of their time is devoted to practical training in the shops, giving close co-operation between theory and practice. There are upper and lower divisions in the schools, the students being sifted by annual examination and graded accordingly, with the result that fourth-year upper school students are of first-rate practical and theoretical ability and may continue with a university course. Thus the majority of entrants become craftsmen with a sound educational background and the remainder provides men of the highest technical and administrative qualifications. These schools are, of course, Admiralty institutions, but similar schools are working with equal success in other branches of industry.

A frequent slogan to-day is, "Secondary Education for All," but this Paper has delineated elementary and secondary types and expressed the probability that it will still be but a small percentage of the whole that will attain secondary standard. This does not mean that financial considerations will decide the issue, as is largely the case at present, for the authors have stressed equality of opportunity. It does mean that they believe that secondary education for all—for some time to come at least—is unnecessary and would lead to dissatisfaction and discontent. They do not believe in the imminent possibility of a millenium, and therefore most men will still have to do manual and monotonous jobs, whilst others, by virtue of superior ability (not opportunity) will reach higher and more congenial standards of labour. It is therefore contended that sound elementary training for the majority is better than an excellent but unsuitable education for all. Given true equality of opportunity the competitive system of elimination for those who merit secondary training will be fair and impartial, and the unskilled labourer of the future will be unable to say, "I didn't have a chance."

## PART II.—INDUSTRIAL EDUCATION

Elementary-school leavers enter industry with unformed minds, with little power of discrimination or choice; they have not taken any real stock of their future, and, being ignorant of their possibilities in life, are often content to fill any post that is vacant when the time comes for them to find a job. The much smaller proportion of secondary and technical school products have gained a sense of discrimination, and are more aware of their capabilities and the uses to which they can be put. Therefore it is found that industries with a large proportion of manual or unpleasant types of labour, under unhealthy or otherwise irksome conditions, are the outstanding sufferers from the present dearth of good apprentices. Such trades can obtain sufficient unskilled or semi-skilled labour, but the more highly educated children will endeavour to avoid entering such industries as long as their ability will find them a job elsewhere.

In support of this contention it is noted that in the textile industry, with its necessarily uncongenial working conditions, those firms which have paid

## Industry and Education

greater attention to the health and general well-being of their workers, suffer least in respect of suitable recruits. If education for all is to be raised to the higher standard contemplated, then the position outlined above will be worsened unless industry as a whole will be able to stand the criticism of the discriminating youth of, say, ten years hence.

Now foundries, textile mills, steelworks, etc., can never become a collar-and-tie job during working hours, but the boy's biggest complaint is not that he is amongst grease and dirt at work, but that he leaves work with evidence of his job still upon his person. That this is not inevitable in the above trades is proved by some of the modern foundries, where workers and staff leave at the same time and are, from personal appearance, indistinguishable. Great stress is laid upon the money incentive, but this is overrated—a boy in the shops frequently gets more money and has better prospects of getting more than his black-coated fellow, but the inferiority attached to manual or dirty work outweighs the advantage of more money. There are at least three points here:—(1) Provide cleaning and bathing facilities; give the operatives accommodation for a suit of working clothes and a place to change at the start and finish of a day's work. (2) Do not make the mistake of thinking that financial betterment will completely overcome the apprentice's aversion to personal discomfort. (3) Discourage the marked segregation between staff and operatives.

### Foundry Apprentices

At the moment boys entering the foundry trade have the advantage that workers with technical training are comparatively scarce and are free from fierce competition for executive positions. The above disadvantages largely account for this state of affairs, but the frequently haphazard training undergone by foundry apprentices still further thins out the numbers who may qualify for worthwhile jobs, thus aggravating the present position which so often places non-foundry trained people in charge of foundries—a state of affairs tending to perpetuate the uncongenial conditions.

Foundry work is by nature less subject to rules and standard methods of procedure than other engineering crafts, and it seems that this is reflected in the treatment of the apprentice. He must not be left to "pick up" his trade, subject to the limitations in experience and ability of the moulder to whom he may be attached. If he is to become a craftsman, then ensure that he is given instruction in every class of work he may have to do. All types of moulds, moulding machinery, foundry routine, etc., are to some extent interchangeable. Hints and tips, the best methods of manufacture, necessary precautions and technique for one job, are useful knowledge for others and discourage the watertight compartments common to industrial routine.

The transition from light repetition work to heavy castings shows a series of overlaps, and he who can call on a knowledge of all classes of work will be able to make a better job of any one section of founding. A boy at school, technical college or university follows a set curriculum, designed to attain a specified goal, such as a qualification, degree, or some other evidence of his efficiency in his subject. No one would consider leaving such a student to casual or haphazard methods of instruction. A foundry apprentice in similar fashion is aspiring to the goal of craftsmanship and should follow a definite course, suitably correlated to the type of foundry and the theory underlying the practice of his craft.

### Scheme of Foundry Training

With the raising of the school age to 15 years and compulsory part-time education to 18 years of age, it is expected that the latter stage will entail instruction pertaining to the boy's trade as the main factor. By dove-tailing his external education to match his working education, a scheme can be applied which will complete the blend of theoretical and practical training and also shorten the period of non-production, inevitable during the training period. The course for the boy entering the industry at 15 years of age would be on the following lines:—Assuming he aims to be a moulder, commence with general application of the different classes of moulding. The boy should be assigned to a competent mouider in each case and his progress noted periodically by allowing him to make on his own a run of castings representative of the particular section he is in, thus developing at the same time his sense of responsibility and giving him the opportunity to learn from his failures.

From the moulding shops he should spend a period in core, fettling and pattern shops to supplement his knowledge of the materials with which he has been working. Coincident with his shop experience, his part-time and evening schooling should cover the properties and characteristics of sands, fluids and metals, as well as practical mathematics and machine drawing; in short, should explain to him the reasons underlying the practices he will tend to learn by rule of thumb in the shop. The productive capacity of the shop will suffer by his more comprehensive training, and alternations between day-rates and piece-rates will have to cover this depreciation of the boy's value to the firm. However, the industry will reap the benefit from the fully trained moulder, and the longer view will justify (1) the necessity to compensate the moulders to take charge of apprentices; (2) paying the apprentice during his periods of inexperience; and (3) encouragement of good trainees by suitable increments in wages for progress made.

### Training of Future Executives

During his apprenticeship both the potential executive and craftsman will follow the same course and a sifting of the boys will inevitably take place. At 18 to 20, organising ability, attention to detail, initiative and desire to extend the scope of the in-

struction will emerge in varying degrees in the different boys. By then the potential executive will have given signs of his particular ability and, whilst the majority will continue a course to produce craftsmen, he will continue a more specialised course designed for an executive or administrative position. Such a course would develop the objective viewpoint, the ability to organise and plan shop routine, a knowledge of metallurgy, costing, piece work and bonus systems, progressing, time and motion study, mechanisation and the economics of modern factory production.

The potential executive then, at 18 years of age, continues his studies at the technical institutions and gains a deeper knowledge of the basic subjects mentioned above. His position in the shop during this time would be that of a type of special moulder, or under-foreman, given work apart from the normal routine—like the leader of an orchestra who is only one of the musicians, but rather a specialised individual. Such courses as outlined above are already working successfully in some British foundries. The completion of his training would involve a year at an institution after the fashion of the British Foundry School, because such specialised training would be beyond the capabilities of the majority of large- and medium-sized foundries or technical colleges. By a proportional pooling scheme amongst the country's foundries, schools for such specialised instruction could be established in the main industrial centres and provide the necessary finishing school for all the future higher executives of the industry.

The rosy and glowing picture painted above is an exposition of the opportunity any apprentice could have, but—and the "but" is a big one—it is necessarily only the absolute cream of the many who will ever attain the final goal of the finishing school. The first year of the craftsman's apprenticeship will see a grading of the new material; some will show early signs of their inability to profit by further instruction, whether by indolence, irresponsibility, lack of mental faculties or sheer inaptitude. These must either join the unskilled operative class or seek their ambition in some other industry. Each successive year will cause a falling off in the numbers who will go forward, and the scheme in operation should provide the foundry industry with the best of all types, labourers, moulders, foremen, metallurgists and managers.

### Generalised not Particularised Training

The apprentice should have the run of the shop before settling down to a specified class of work. Apart from developing his skill as a moulder, this is to retain his interest. For instance, the foundry on heavy, medium and light castings needs no investigation from this point of view, but increasing mechanisation and specialisation are tending to direct the industry into mass-production channels, using a higher proportion of unskilled labour confined to one class of work; the light repetition foundries—moulding machines and green sand—for example. Work here is monotonous and fatiguing, variety and scope for learning are limited, yet this industry will also need boys. However, opportunity for learning should be as wide as the class of work will allow, and encouragement to enter and remain in the industry will rest on three points:—(1) This class of work tends to need more executives than the more general foundry, and chances of promotion are proportionately greater. (2) Betterment of working conditions should include rotation of labour (more feasible in light repetition work) and more frequent rest and recreation periods. (3) An impartial time-and-motion standard basis of payment, enabling the operatives to earn a basic living wage without undue fatigue.

Adoption of such schemes as the above will meet opposition from industrialists and employees—one because of the time and money expended for no immediate return, the other through innate conservatism. The industrialist's viewpoint would lack foresight because the increased efficiency and content of his operatives will give him good return from his investment. The employee's objection will fade once the changes have been made and overcome the inertia which keeps him so grooved and inflexible. For instance, rotation of labour already mentioned has been a success in many factories, beneficial both to production and operatives, but the latter raised strong objections at first.

### General Conclusions

In this Paper the authors have ignored economics and their close associate, politics. This has necessarily resulted in taking for granted the absence of many aspects which cry for consideration in any Paper on education and industry. Modern manufacturing methods—aptly termed "machinofacture"—have encouraged the use of female, child and unskilled labour, and in these trades the craftsman has outlived his usefulness; there are grades of interlocking specialisation—the rationalisation of industrial processes. This has tended to the casualisation of labour and the anomaly has been found of great unemployment in the 18 to 20 age-group, while industry has complained of a shortage in the 14 to 18 years' group. A machine minder need not serve an apprenticeship and the latter has been replaced by "learnership" agreements—of doubtful long-term value to the industry. A boy, seeking to gratify his ambition, studies and qualifies himself for a better job, only to find it does not exist.

The terrific overall speed-up in production *per capita* has brought many evils in its wake—ennui and absenteeism from sheer monotony, blind-alley jobs, exploitation, death of the apprenticeship system, seasonable occupations and, above all, a rooted distrust in people's minds of those trades most affected by mass-production. These problems are being tackled by employer, employee and the State, and will be solved. In the meantime the educational system can only be planned to suit the better conditions that will prevail and, fortunately, the craftsman still exists in the foundry industry and, until he is no longer needed, there is good reason to make the apprentice interested and capable in his job.

(*Concluded on page* 259.)

## GETTING SCRAP MINDED

By "ONLOOKER."

It is the way of all wars that, although they bring much evil, there are invariably compensations of one kind and another, often in the fields of science and medicine, which are harnessed to the war machine both for the purpose of taking life and saving it. Research on some particular problem is pursued feverishly often enough, and it is not unusual to see the work of years under normal conditions crowded into the short space of a few months when the nations are making war. It may seem at first strange to suggest that the period of the war has been productive of considerable research in the realm of scrap metal, for, indeed, this is not a commodity which one normally connects with the painstaking and extensive surveys instituted by the research chemist. Nevertheless research has gone on under the spur of a need to conserve shipping space and to utilise to the greatest possible extent stocks of metal in our own country. The form in which these inquiries have been pursued, however, has been one of trial and error in the foundries and casting shops rather than experiments in the laboratory. Percentage inclusions of secondary metal in the heats prepared for a charge of metal have been raised by stages, careful tests being made at the finishing and on the production line to ensure that quality has not deteriorated.

That, however, is only one aspect of the matter, and so long as high-grade scrap was in question, the chances of difficulties arising were not very great. The hard core of the problem of total scrap utilisation has always been the quantity of low-grade and contaminated material which accumulates so long as consumers are able to acquire adequate tonnages of new metal. In pre-war days much of this was sold to Continental users, often enough at surprisingly good prices, but there can be no doubt that in our own treatment of alloy scrap we were sometimes wasteful, recovering copper perhaps, but allowing zinc, or possibly some other constituent, to be wasted. There was a stage earlier in the war when very considerable accumulations of apparently unusable, and certainly unpopular, scrap existed in this country. Prices of certain types declined steeply and suggestions came from more than one quarter that the right thing to do was to ship this material to the United States for treatment at the seaboard refineries. This did not happen, but the Control set to work to cope with the problem on the spot, one of their first actions being the issuing of an instruction, more persuasive than peremptory, to the effect that certain minimum percentages of brass swarf should be included in the casting of billets intended for extrusion into fuse rods.

As a result of this inroads were made upon the immobilised masses of secondary metal, and to such good purpose has the campaign been waged that to-day there is actually a scarcity of brass swarf, and indeed of other types, too, for the country has become "scrap minded" during these years of war. How has this happened? Mainly because the ever-rising tempo of munitions production, not only in Britain, but also in the United States, has made severe and increasing calls upon the virgin metal supplies, thus making it vital that consumers should dip heavily into reserves of scrap. We must remember, too, that America has been sending us copper and spelter, at any rate, under Lend/Lease arrangements, and in these circumstances it was obviously our plain duty to draw on any reserves we possessed. Above all there was a crying need to save shipping space in the face of U-boat attacks and our tonnage needs in the North African campaign. So consumers have bent their backs to the task and are now using more scrap than most of them would have thought possible in pre-war days.

## SOME OBSERVATIONS ON THE USE OF SYNTHETIC SANDS

(*Concluded from page* 267.)

portions which necessitated breaking up in heavy roller mills, thereby involving a great deal of labour.

**Summary**

(1) Frequent tests should be carried out on moulding sands to ensure that variations do not take place in the physical properties. Test figures on sands cannot always be taken as a complete guide but the information obtained would be very important if an analysis on casting defects was also made.

(2) The use of dry materials in the preparation of synthetic sands cannot be sufficiently overstressed, as also of allowing a period of dry mixing in the sand mill before water additions are made. If these points are not taken into account trouble will be encountered because, apart from the resultant inferior mixture, adherence of the materials to the mill pan and rollers will take place. Recent tests carried out by the A.F.A. have shown that 21 per cent. less power is needed to drive the mill if in clean condition, than to drive it with sand caked on the mill parts.

(3) To obtain good flowability a certain amount of fines is necessary, but if excessive accumulation is allowed to take place a large amount of water would be needed to make the sand sufficiently mouldable.

(4) With synthetic sands a rigid control on all sand operations is essential. This control, with the selection of satisfactory materials, would ensure successful results.

## AUSTRALIAN CONVERTER PRACTICE

In a Paper which Mr. E. S. Playford, of the Davis & Baird Pty., Limited, presented to the April meeting of the Institute of Australian Foundrymen, he outlined the converter practice at use in that foundry. Based on an all-steel charge, plus ferro-silicon melted in a modified balanced-blast cupola, the metal is desulphurised by the use of soda. The main types of steel made are low carbon, medium straight carbon (40 tons tensile minimum); both pearlitic and austenitic manganese; medium chrome; nickel chrome; straight carbon (flame hardening); high carbon, high chrome, and C, Si, Ni hot-roll steel.

# SOME OBSERVATIONS ON THE USE OF SYNTHETIC SANDS

The main object sought with the adoption of sand control has been to help in the prevention of defective castings directly attributable to sand. It would seem, however, that the success achieved in this direction has been more pronounced in foundries where synthetic sands are used. Undoubtedly, greater control can be exercised on synthetic sands than on natural sands, due to the selection and adjustments of materials that can be made to obtain properties most suitable to local conditions.

In the foundry with which the author is connected, production of castings with synthetic sands represents one-third of a large output, and since the sands were first introduced over two years ago a marked reduction in sand defects has been shown. Due to the widely differing properties of synthetic and natural sands, careful consideration had to be given to all aspects affected by the change to synthetic sands. The three main points were, selection of suitable materials, method of changeover, and effects upon moulding conditions.

### Choice of Materials

In view of the high pouring temperature of the metals it was essential that the base silica sand selected should be fine grained and of good refractoriness. These factors would ensure against metal penetration of the mould face, with the result a smooth surface finish would be obtained on the castings.

Additionally, the bonding material needed to be of high refractoriness, and high bonding power. Wyoming bentonite proved to be highly satisfactory, but due to wartime conditions it was necessary to find an alternative. Numerous experiments were carried out in the laboratory on various materials, and the most suitable for our class of work proved to be Fullers earth. Very good castings results have been obtained from this material, but it has its limitations and Dunbeck in a communication to the I.B.F. sums up the material very ably by saying: "Fullers earth is very light in weight, as a result it is difficult to handle and dusty in use. It develops strength slowly and requires intensive milling. Probably because of its porous nature it requires more tempering water than other bentonites. An advantage is its high flowability."

### Method of Changeover

The natural sands in use were of low permeability and refractoriness, also a high percentage of water was needed to give the sand sufficient moulding strength. In view of these conditions it was considered advisable to have a complete changeover to synthetic sand by discarding the natural sands and use a mixture made entirely of silica sand and bentonite. Whether to have an immediate or gradual changeover to synthetic sand has been a debatable point with foundrymen. It has been said that a gradual changeover would be more advisable. This would be carried out by replacing the natural sand additions with silica sand additions. This method would be more economical, but where the original base sands are low in permeability, large additions of new silica sand would be needed to maintain the properties of the synthetic mixtures.

### Moulding Conditions

From commencement of moulding with synthetic sands an almost complete elimination of sand defects was made, although during the experimental stages one defect caused a little concern. There was a tendency for hot tears and minute cracks to occur on castings, particularly in irregular sections. Some improvement was effected by the addition of ties, but the trouble was not entirely overcome until the disintegration of the moulding sand was carried out. This operation succeeded in breaking up hard portions of sand that were present after milling, thereby making a more evenly tempered moulding sand.

When using natural sands sufficient new sand has to be added so that strength for moulding can be maintained and consequently the used sand is scrapped to make way for these additions. In synthetic practice, however, when strength deterioration takes place, reconditioning of the sand can be made by remilling with a small amount of bonding material. This operation gives the sands their original quality, for the properties are still good except for weakness in bond strength.

### Sand Mixtures and Properties

The synthetic mixture most suitable has been 20 per cent. silica sand, 1 per cent. bonding material, 2 per cent. coal dust, and made up to 100 per cent. with backing sand. Only for a brief period has this mixture been altered. After 18 months' use the sand grains began to break up resulting in a reduction of permeability. To increase the permeability to the desired level 50 per cent. silica additions were made for two weeks, and then returned to the original standard. No further trouble has since been encountered.

*Average Properties of Synthetic Sands.*—Moisture, 4.50 to 5.00 per cent.; green compression, 5.50 to 6.00 lbs. per sq. in.; permeability number, 50 to 60.

*Average Properties of Natural Sands.*—Moisture, 6.75 to 7.25 per cent.; green compression, 5.50 to 6.00 lbs. per sq. in.; and permeability number, 18 to 25.

### Utilisation of Burnt Core Sand

Utilisation of burnt core has been made in the synthetic part of the foundry by using disintegrated burnt core as new sand additions. Results on the final mixtures have been equal to those obtained with new sand; but extension of the scheme has been handicapped by foundry conditions. First, the greater output of castings is as yet being produced with natural sands, with the result the disintegrated burnt core becomes mixed with the natural sands, making it unsuitable for use in synthetic sands. Secondly, some cores would not be quite burnt, leaving very hard

(*Concluded on page* 266.)

## INCANDESCENT HEAT COMPANY

A scheme of arrangement between the Incandescent Heat Company, Limited, furnace manufacturers, of Smethwick, and their preference and ordinary shareholders, was sanctioned by a Chancery Court last week. Mr. Justice Simonds said the scheme seemed to be very fair.

Mr. Gordon Brown (for the company) said the capital was £168,000, divided into 140,000 preference shares of 4s. each and 140,000 ordinary shares of £1 each; 26,065 of the preference shares and 131,436 of the ordinary shares had been issued. The preference shares carried a fixed 7 per cent. tax-free cumulative dividend and the right to have distributed among the holders one-third of any balance of profits available for dividend. No dividend had been paid on the issued preference shares, and the arrears in December last amounted to £7,498. Under the scheme the special rights and privileges attaching to the preference shares, including the fixed cumulative dividend, were to be cancelled and the shares converted into £5,213 ordinary stock. Each £1 ordinary share was to be sub-divided into five ordinary shares of 4s. each, and these were to be converted into £131,436 ordinary stock. The holders of this ordinary stock were to contribute for the purposes of the scheme £26,287 of the stock, in proportion to their holdings. In consideration of the preference shareholders consenting to the cancellation of the arrears of dividend, £5,435 of the £26,287 ordinary stock to be contributed was to be distributed rateably among the holders of the preference shares, and in consideration of the cancellation of the other preferential rights attached to the shares, the balance (£20,852) of the £26,287 ordinary stock was to be distributed similarly among the holders of the preference shares.

## INTRUSION OF POLITICS IN INDUSTRY

In a statement accompanying the report and accounts of William Baird & Company, Limited, the chairman, Mr. Robert L. Angus, remarks with regret that the future of industry in this country, and in particular the basic industries, is the subject to-day of political controversy, war conditions having presented the enemies of private enterprise with their opportunity to advocate their untried theories. Post-war conditions in themselves will present such great difficulties that it is to be deplored that these should be complicated by the intrusion of politics in industry.

If the difficulties are to be overcome of giving re-employment to the millions presently in the services and engaged directly and indirectly on war work and of restoring our export trade at least to such an extent as will enable the nation to pay for its necessary imports of food and raw materials, it is essential that private enterprise should be assured of a fair field. Mr. Angus expresses the hope that such an assurance will be forthcoming without delay, thus enabling those who are fitted from their training and practical experience to overcome the difficulties to face the problems of reconstruction.

## POST-WAR TRADE WITH INDIA

Mr. L. S. Amery, Secretary of State for India, presiding at a meeting of the Institute of Export recently, said that there were few subjects of greater importance to the future welfare of this country than that of its external trade and, not least, of its trade with the populous and rapidly developing people of Asia.

India was, and would remain, a predominantly agricultural country, but at the same time she had all the latent resources of raw materials, power and human skill calculated to make her a great industrial country. In the immediate post-war period our opportunity for co-operating most effectively with Indian requirements and aspirations would undoubtedly be in the provision of capital goods, which would be urgently needed for industrial re-equipment and expansion. Later on it might lie more in the provision of more specialised types of consumers' goods. In either case our success would correspond directly to the extent to which our trade policy was one of whole-hearted co-operation in India's effort to raise herself to a higher plane of economic efficiency.

## REMOVABLE BLACK-OUT

Permanent black-out in factories involves heavy consumption of fuel for artificial lighting during daylight hours, besides being less pleasant and healthy than natural lighting. The Ministry of Production, after consulting the Ministry of Fuel and Power and other Government departments, has decided that further steps shall be taken to substitute removable shutters or blinds in place of permanent black-out.

The labour and materials for this work must be obtained, wherever possible, from supplies already available. The shortage of steel, timber and textiles will delay the carrying out on a large scale of conversions requiring special allocations of material and additional labour. Where, however, the fuel saving is substantial in relation to the amount of material required for the conversion, consideration may be given to an application for a special allocation.

## STEEL HOUSES

MR. ASTOR asked the Parliamentary Secretary to the Ministry of Works whether he would have a report made on the steel houses erected after the last war, to determine whether they had been satisfactory from all points of view.

MR. HICKS: The committee which was jointly set up by the Minister of Health, the Secretary of State for Scotland and Lord Reith, to report on methods of house construction, has fully covered the various types of steel houses erected after the last war, and its report, which is now being drafted, will shortly be presented.

SIR FRANCIS FREMANTLE: Will this committee be working in co-operation with the sub-committee—of which I am a member—of the Ministry of Health which is dealing with exactly the same problem?

MR. HICKS: I am amazed to find that you have not already consulted with each other.

# STANTON DALE

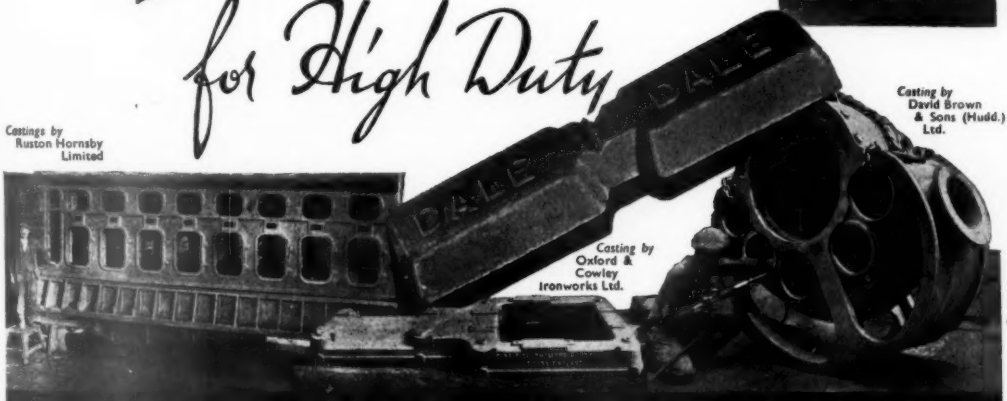
## Refined PIG IRON

## for High Duty

Castings by Morris Motors Limited.

Casting by Baker Perkins Limited

Castings by Ruston Hornsby Limited




Castings by Ruston Hornsby Limited

Casting by David Brown & Sons (Hudd.) Ltd.

Casting by Oxford & Cowley Ironworks Ltd.

THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM.

## NEWS IN BRIEF

THE OFFICIAL cost-of-living index figure on July was 100 points above the level of July, 1914, as compared with 98 points a month earlier and 55 points at September, 1939.

THE MINISTER OF SUPPLY has accepted with regret the resignation, owing to ill-health, of Mr. E. W. Muirsmith, chairman of the Industrial Companies' Supervisory Board, Ministry of Supply.

THE ANNUAL REPORT of the directors of John Lysaght, Limited, states that the company has acquired the whole of the issued capital of the Uskside Engineering Company, Limited, Newport.

MR. ERIC A. JOHNSTON, president of the United States Chamber of Commerce, has accepted an invitation from the British National Committee of the International Chamber of Commerce to visit Britain early in August.

IN A BLACK COUNTRY FOUNDRY deaf and dumb men are being trained under their own leader to do specially suitable work of national importance. The experiment is being watched with interest by the Ministry of Labour, Mr. Bevin stated in the House of Commons.

THE STEEL MELTING FURNACES at the Haulbowline Works in Eire are nearing completion and are expected shortly to be in production. The plant consists of two 35-ton open-hearth furnaces embodying the most modern design and appliances. They will operate on a high percentage of scrap, and it is understood that there is sufficient in Eire of a suitable grade to supply the demand for a considerable time.

PRESIDING AT THE annual meeting of the British Standards Institution, Sir Percy Ashley, the chairman, said that the Government had decided to increase substantially the grant-in-aid which, during the coming year, would be approximately £12,500, or nearly double the former grant. There were in current use to-day about 1,500 British Standards, and during the year under review 230 new and revised standards or amendments had been issued.

A DOCUMENTARY FILM, "The Old Iron Way," was recently exhibited to a private audience in London, prior to general release. Scrap iron and steel—mainly the latter—was shown on its journey through various stages, including weighing, sorting, cutting by hand and mechanical devices until it reached the point of consumption. Mr. J. W. Langley, of Cox & Danks Limited, in conjunction with British Foundation Pictures Limited, was responsible for production.

FIFTY-EIGHT MEN employed in the foundry department of the Austin Works at Birmingham were recently each fined £15 by the Birmingham Stipendiary on a summons for unlawfully taking part in a strike "in connection with a trade dispute not reported to the Ministry of Labour and National Service." The strike commenced on June 15, and the men resumed work on June 22. It was explained that in March last a national agreement gave an increase to machine moulders, and the dispute arose from a demand concerning piece rates.

## PERSONAL

MR. E. HALLAS has been appointed technical sales manager to the Brightside Foundry & Engineering Company, Limited.

MR. CHARLES ROBSON, secretary of Ashmore, Benson, Pease & Company, Limited, has been elected a member of Stockton-on-Tees Town Council.

MR. T. G. N. HALDANE, a partner in the firm of Merz & McLellan, consulting engineers, has been elected a vice-president of the Institution of Electrical Engineers.

MR. WILLIAM THOMSON has received a presentation from the staff and employees of William Bain & Company, Limited, Lochrin Ironworks, Coatbridge, on retiring from the position of manager after 50 years' service in the works.

### Wills

| | |
|---|---|
| WITTS, H. V., of Swansea, metal merchant ... ... | £7,467 |
| ROBERTS, A. C., a director of Turner & Newall, Limited ... ... ... ... ... ... ... ... | £113,370 |
| BURTON, T. G. H., of East Grinstead, Sussex, engineer ... ... ... ... ... ... ... | £22,703 |
| PALIN, F. G., a director of the British Metal Corporation, Limited ... ... ... ... ... ... ... | £28,625 |
| CHRISTIE, COLIN, of Sheffield, stainless steel fittings manufacturer ... ... ... ... ... ... | £7,541 |
| SHAW, C. R., a director of Lancashire Dynamo & Crypto, Limited ... ... ... ... ... ... | £71,962 |
| JENKINSON, W. B., of Sheffield, a director of the Yorkshire Testing Works, Limited ... ... | £36,475 |
| SMITH, F. G., a director of the Wellman Smith Owen Engineering Corporation, Limited ... | £33,041 |
| HOLLADAY, E., managing director of Garton & King, Limited, engineers and ironfounders, of Exeter | £27,391 |
| BUCKLEY, G. H., of Wolverhampton, a director of Rubery, Owen & Company, Limited, and Brooke Tool Manufacturing Company, Limited ... ... | £37,964 |
| PERKINS, J. E. S., of Peterborough, late chairman of Barford & Perkins, Limited, and director of Agricultural & General Engineers, Limited ... | £73,739 |

## OBITUARY

MR. SIDNEY WOODWARD, secretary and a local director of Cammell Laird & Company, Limited, has died suddenly at the age of 63 years.

MR. JOSEPH LEGGE, founder and chairman of J. Legge & Company, Limited, brassfounders and lock manufacturers, of Willenhall, died last week, aged 83.

LT.-COLONEL WALTER BRIDGES, principal of Walter Bridges & Company, consulting engineers, London, S.W.1, and chairman and managing director of the Projectile & Engineering Company, Limited, London, S.W.8, died recently, aged 71 years.

MR. ALLAN HANNAH, J.P., who was outdoor commercial representative of John G. Stein & Company, Limited, firebrick manufacturers, Castlecary, with whom he worked for 35 years, died in Edinburgh recently. He was a member of the council of St. Andrew's Ambulance Association, and was keenly interested in the furtherance of the ambulance movement in Scotland.

## THE EVOLUTION OF THE FOUNDRY PATTERN

In human progress, the originators have been few, the imitators have been legion ; yet out of the imitative characteristic has arisen the vast increase in articles of everyday life, which, in modern times has culminated in our mass production methods. Our remote forbears, having originated a stone implement, or, less remotely, a bronze implement, doubtless taught the art of fabricating it, by using it as a model and having it copied by the craftsmen to be. It may well be supposed that improvements in methods were very very slow, and indeed it is indisputable that only in quite recent times has production of articles by such scientific procedure as repetition casting received notable impetus. The provision of enduring patterns in metals, or such materials as Cummingstone, a hard marble-like substance capable of producing thousands of castings from the one pattern, has greatly helped in this development whereof the ultimate result is a better article at a much reduced cost. Cummingstone is manufactured and sold by Wm. Cumming & Co., Ltd., at their various works at Glasgow, Falkirk, Chesterfield, Deepfields and Middlesbrough.

# COMPANY NEWS

*(Figures for previous year in brackets.)*

**Crossley Bros.**—Dividend of 5% (same).

**Spear & Jackson**—Dividend of 12½% (same).

**Crossley-Premier Engines**—Dividend of 10% (same).

**Bennis Combustion**—Final dividend of 5%, making 10% (same).

**Hobbs, Hart & Company**—Net profit to March 31, £6,968 (£4,587); ordinary dividend of 6% (2½%).

**Silentbloc**—Net profit to May 31, £19,171 (£19,102); dividend of 25% (same); forward, £7,208 (£6,787).

**William Baird**—Net profit for year ended May 31 last, £156,293 (£155,183); ordinary dividend of 15% (same).

**Greenwood & Batley**—Profit, after tax, for year to March 31 last, £110,098 (£103,034); ordinary dividend of 15% (same).

**George Spencer Moulton & Company**—Profit for 1942, £73,212 (£62,751); dividend of 5% (same); forward, £22,265 (£21,603).

**Scottish Stamping & Engineering**—Profit for 1942, £15,742 (£14,648); to reserve, £5,000 (same); dividend of 10% (same); forward, £4,120 (£3,411).

**Hick Hargreaves**—Net profit to March 31, £34,305 (£31,816); dividend of 10%, £24,000 (same); to contingency reserve, £10,000 (£5,000); forward, £5,308.

**George Kent**—Net profit, after tax, for year to March 31, £67,358 (£75,611); ordinary dividend of 10%, plus a bonus of 2½%, making 12½% (same); forward, £40,132 (£50,667).

**Vickers**—Interim dividends of 2½% actual, less income-tax, on the preferred 5% stock and 5% preference stock, and 2½% actual, free of income-tax up to 6s. in the £, on the cumulative preference stock.

**Steel & Company**—Net profit to March 31, after income-tax and E.P.T., £30,212 (£22,600); depreciation, £10,324 (£6,033); to reserve, £4,953 (£2,500); ordinary dividend of 10% (7½%); forward, £8,618 (£3,783).

**Triplex Foundry**—Loss for the year ended March 31, after charging depreciation, £2,735; brought in, £8,144; bad debts reserve no longer required, £7,500; dividend on the preference capital, £2,062; to general reserve, £5,000; forward, £5,847.

**Gaskell & Chambers**—Net profit for 1942, after depreciation, war damage contributions and taxation, £40.372 (£21,688); dividend of 10% (same), plus a bonus of 10% (same); building reserve, £20,000; forward, £22,992 (£24,628).

**John Lysaght**—Profit for 1942, after providing for debenture interest, taxation, deferred repairs and war damage insurance, £501,205 (£465,859); to depreciation, £150,000 (£120,000); dividend on the ordinary capital of 15 per cent., tax free (same).

**Manley & Regulus**—Trading profit to April 30, £127,842 (£127,893); maintenance and/or depreciation, £24,779 (£24,199); net preference dividend, £700 (same); ordinary dividend of 10%, £6,376 (same); taxation, £85,070 (£85,945); war damage, £981 (£1,783); forward, £41,071 (£31,635).

**Allied Ironfounders**—Net profit for the year to March 31, £322,130 (£316,364); to general reserve, £72,004; to contingencies and development reserve, £75,000; 7% cumulative preference dividend, £36,014; ordinary dividend of 7½%, £65,041; forward, £214,522 (£183,706).

**Darlington & Simpson Rolling Mills**—Net profit for the year to March 31, £62,277 (£59,787); general reserve has been increased to £139,800 by the addition of £23,500 transferred from profit and loss and £9,800 E.P.T. provided in past years, no longer required; ordinary dividend of 7½%.

**Metal Box**—Trading profit for the year to March 31 last, after E.P.T., depreciation, etc., £590,425 (£579,453); tax, £345,000 (£340,000); net profit, £218,881 (£210,369); to development and reorganisation reserve, £100,000 (nil); final dividend and bonus of 12½%, making 17½% (same); forward, £140,922 (£186,928).

**Briton Ferry Steel**—Net profit for the year to April 3 last, £211,432 (£205,544); staff bonus, £5,471 (£4,640); depreciation, £50,000 (£40,000); special reserve for additions, improvements and renewals, £30,764 (£20,000); taxation, £70,000 (£90,000); final dividend on the ordinary stock of 7½%, making 10% (same); forward, £51,228 (£48,379).

**General Electric Company**—Profit to March 31 last, £1,748,917 (£1,725,137); depreciation, £459,619; pensions, £89,276 (£78,911); income-tax reserve, £700,000 (£685,000); 6½% "A" preference dividend, £58,500; 7½% "B" preference dividend, £67,500; 10% ordinary dividend, £209,919 (same); 7½% bonus, £157,439 (same); forward, £817,762 (£815,379).

**Harland & Wolff**—Profit for 1942, £990,329 (£967,302); dividends and interest on investments, £15,697; income-tax, £368,394 (£384,768); staff pension fund, £12,952 (£12,948); depreciation, £400,000 (same); dividend of 6% (same) on the "A" ordinary shares, less tax, £156,000; dividend of 6% (same) on the "B" ordinary stock, £53,882; forward, £87,066 (£74,268).

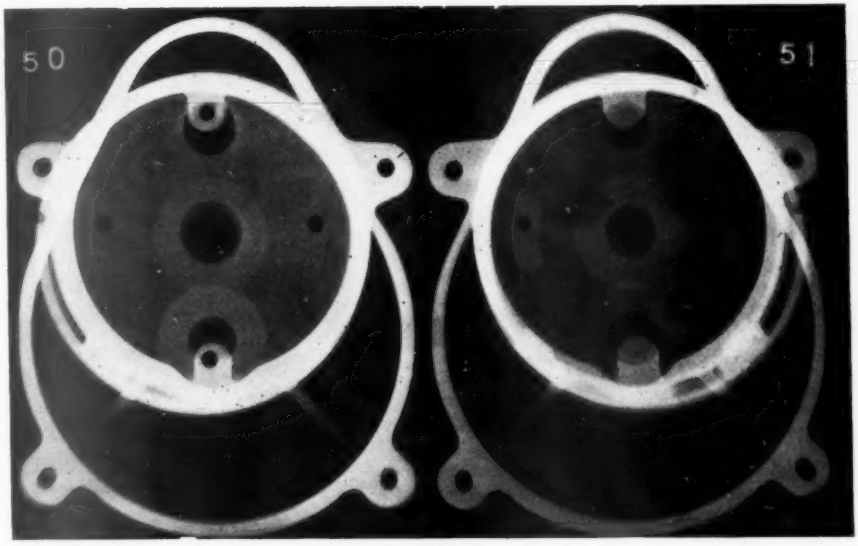
**Edgar Allen & Company**—Trading profit, etc., for year to April 3, £457,781 (£333,073); depreciation, £37,626 (£31,782); tax, £370,000 (£250,000); war damage contribution, £3,400 (£4,500); net profit, £46,455 (£39,891); preference dividend, £7,500; ordinary dividend of 12½%, less tax, £17,956 (same); to general reserve, £20,000 (£15,000); forward, £37,340 (£36,341).

**Wales**—Trading profit for 1942, after providing for A.R.P. expenditure and premiums under the War Damage Act, and including the profit made by the subsidiary company and income from investments, £28,077 (£28,702); depreciation, £3,062; taxation, £16,600; dividend on the cumulative preference shares, £600; dividend on the ordinary shares of 12½%, £6,250 (same); balance of 1943/44 income-tax, £4,800; forward, £9,835 (£13,682).

**W. & T. Avery**—Net profit for the year ended March 31, £138,150 (£130,407); preference dividends, £7,587; interim dividend of 5% on the ordinary stock, £21,532; final dividend of 10%, making 15% (same), £44,488; to general reserve, £10,000; to contingency (war) reserve, £45,000; to pensions fund reserve, £10,000; forward, £66,818 (£67,275). Tax deducted from the final ordinary dividend will be at the rate of 9s. 7d. in the £, owing to relief from Dominion income-tax.

# TWO CASTINGS

## —*with a Difference*




*Here is a perfect specimen.* *Here is a faulty specimen.*

Light-alloy castings which had not previously been under radiographic inspection were being machined, when surface defects appeared. This prompted an X-ray examination to determine the extent of the defects: and these were revealed as the dark diffuse shadows in the radiograph (figure on right)—compare with the radiograph of a fault-free casting on the left.

As with this casting, so with many others, radiography before machining will eliminate defective specimens *before* costly machining operations have been expended on them. For such routine inspection of light alloy castings the supreme X-ray film is 'Industrex' Type D film.

## 'INDUSTREX' Type D FILM

**KODAK LTD.,** *Kingsway, London, W.C.2*

# Raw Material Markets

## IRON AND STEEL

Supplies of raw materials for use in ironfoundries are coming forward satisfactorily as far as quantity is concerned. The better grades of iron, which are manufactured from imported ores, continue to be scarce and distribution is very carefully regulated. Other qualities, such as high-phosphorus iron, which is produced from ores obtained in the United Kingdom, are in ample supply and are fulfilling a particularly useful service now that the better grades are difficult to procure. It is hoped that larger tonnages of iron ore will eventually be despatched from North Africa; ore from this source is, of course, now at the disposal of the Allies, but the question of delivery hinges on the shipping situation, and at present it is felt that cargo space can be used to more desirable effect in other directions.

Makers of heavy castings have felt the limitation of supplies of hematite, low-phosphorus iron, etc., more sharply than other consumers, as, in normal times, they relied almost solely on these descriptions, whereas the light-castings foundries, for example, have always absorbed large quantities of high-phosphorus iron, which continues to be available to them as required. Activity in the latter branch of the foundry industry is still rather disappointing and, apart from those works which have been able to adapt their plant to the production of heavier castings, few of the foundries are operating on a full-time basis. Wartime demands on the resources of the heavy engineering works have been very insistent all along, with the result that order-books are filled over some time to come.

No difficulty is experienced in getting coke delivered to points of consumption and ample quantities are available, so that many consumers have taken the opportunity to stock during the summer months. Last winter there was rarely any hold-up in the flow of coke supplies, but it is a wise precaution for users to have maximum stocks on hand.

The re-rolling mills are confronting a long period of full-scale operations. Big tonnages of bars, light angles, rounds, squares and flats are on order, and some of the sheet mills have been switched over to the rolling of light plates for the shipyards. The demand for steel plates is still the high spot of the finished steel trade and as a matter of urgency American plates are being released from stock for certain purposes. Extension of welding has not diminished the pressure for rivets, while the war departments' requirements impose increasing strain upon the wire mills. Engineering establishments are absorbing large tonnages of steel plates and sections and there is a steady demand for colliery and railway equipment.

Generally speaking, supplies of iron and steel scrap are in excess of the requirements of the foundries and steelworks, although these remain at an appreciable level. Efforts to bring out as much scrap as possible have been well rewarded, with the result that merchants are able to keep pace with their heavy commitments. In certain areas, however, consumers are not receiving the grades for which they specify, and it is still incumbent on all concerned to foster the collection of old metal.

## NON-FERROUS METALS

It is customary in the non-ferrous metal trade for works to close down during August Bank holiday week. In wartime it is necessary to make the utmost use of this recess for the carrying out of repairs and renewals, as there will be no further opportunity until the Christmas break and then the weather and light are less favourable than they are at this time of the year.

Ample supplies of copper are available to consumers in this country and delivery hinges on the shipping position. In view of the vital need to conserve shipping space, it has not been deemed advisable to bring in supplies much above the level of consumption. Recently, however, demand has tended to fall away to some extent owing to changes in armaments production, so that it is possible that small reserve stocks may now be accumulated. The revision of specifications has been accompanied by extended utilisation of copper scrap and these factors have materially alleviated the supply situation.

The Secretary of the American Copper Association has recommended that the U.S. Government should acquire excess domestic and Latin-American output for six to twelve months after the war.

While tin is still, of course, in very short supply, there seem to be few occasions when real hindrance is caused, as the development of the use of substitutes has been very considerable and, in many instances, a revelation. Until the tinfields of Malaya and the Dutch East Indies are recaptured from the Japanese, tin will remain difficult to procure, and it may be a considerable time after the deposits are again in the possession of the Allies before production returns to normal, as much reconditioning, re-equipping, etc., will have to be carried out in the initial stages. Tin producers and others interested in the tin industry appreciate the efforts which will have to be made if tin is to recover the ground it has ceded to alternative materials since the supply emergency arose and it is likely that some scheme involving widespread development and research will be embarked upon in an endeavour to restore the position.

Essential lead requirements are being satisfied promptly, thanks to regular arrivals from our sources of supply. Demands for vital purposes have been steady for some time past and it does not seem likely that there will be much fluctuation in the early future. Should the necessity arise, it would undoubtedly be possible to procure additional lead from Australia *via* the Mediterranean route, which is now, of course, open to Allied shipping, but here, again, the shipping question is paramount, and while shipping space is so valuable the authorities are unlikely to press for more space to be allocated to lead imports.

# Patch

WORN FURNACE BRICKWORK WITH

# Durax No. 1

PLASTIC FIREBRICK COMPOSITION

BEFORE

...AND AFTER

WHEN quick repairs to worn furnace brickwork are required, Durax No. 1 provides an excellent patching medium. It is supplied in a stiff, plastic condition ready for use. It possesses exceptionally high refractoriness, negligible shrinkage on drying, and good resistance to thermal shock.

Durax No. 1 is also frequently used as a rammed monolithic lining in small size furnaces, such as crucible furnaces, owing to the ease of installation — the avoidance of special shapes—and because it provides a strong, durable structure. Users who require further information concerning the uses of Durax No. 1 should communicate with the G.R. Technical Department.

**General Refractories**
LIMITED

GENEFAX HOUSE, SHEFFIELD, 10
TELEPHONE: 31113 (6 LINES)

FIREBRICKS · BASIC BRICKS · ACID-PROOF MATERIALS · CEMENTS
PLASTICS · INSULATION · SILICA BRICKS · SILLIMANITE · SANDS

37

# CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

*(Delivered, unless otherwise stated)*

**Wednesday, July 28, 1943**

## PIG-IRON

**Foundry Iron.**—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

**Hematite.**—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

**Low-phosphorus Iron.**—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

**Scotch Iron.**—No. 3 foundry, 124s. 9d.; No. 1 foundry 127s. 3d., d/d Grangemouth.

**Cylinder and Refined Irons.**—North Zone, 174s.; South Zone, 176s 6d.

**Refined Malleable.**—North Zone, 184s.; South Zone, 186s. 6d.

**Cold Blast.**—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

## FERRO-ALLOYS

*(Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.)*

**Ferro-silicon** (5-ton) lots.—25 per cent., £21 5s.; 45 per cent., £23 10s.; 75 per cent., £36 10s.

**Ferro-vanadium.**—35/50 per cent., 15s. 6d. per lb. of V.

**Ferro-molybdenum.**—70/75 per cent., carbon-free, 6s. per lb. of Mo.

**Ferro-titanium.**—20/25 per cent., carbon-free, 1s. 3½d. lb.

**Ferro-tungsten.**—80/85 per cent., 9s. 8d. lb.

**Tungsten Metal Powder.**—98/99 per cent., 9s. 9½d. lb.

**Ferro-chrome.**—4/6 per cent. C, £44; max. 2 per cent. C, 1s. 0½d. lb.; max. 1 per cent. C, 1s. 1½d. lb.; max. 0.5 per cent. C, 1s. 1½d. lb.

**Cobalt.**—98/99 per cent., 8s. 9d. lb.

**Metallic Chromium.**—96/98 per cent., 4s. 5d. lb.

**Ferro-manganese.**—78/98 per cent., £18 10s.

**Metallic Manganese.**—94/96 per cent., carb.-free, 1s. 9d. lb.

## SEMI-FINISHED STEEL

**Re-rolling Billets, Blooms and Slabs.**—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

**Billets, Blooms and Slabs for Forging and Stamping.**—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s. 6d.; acid, up to 0.25 per cent. C, £16 5s.

**Sheet and Tinplate Bars.**—£12 2s. 6d., 6-ton lots.

## FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

**Plates and Sections.**—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 in. ins., £15 8s.; tees, over 4 in. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

**Bars, Sheets, etc.**—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

**Tinplates.**—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

## NON-FERROUS METALS

**Copper.**—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

**Tin.**—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

**Spelter.**—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

**Lead.**—Good soft pig-lead (foreign) (duty paid), £25 ditto (Empire and domestic), £25; English, £26 10s.

**Zinc Sheets, etc.**—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

**Other Metals.**—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

**Brass.**—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11½d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10½d.; wire, 10½d.; rolled metal, 10½d.; yellow metal rods, 9d.

**Copper Tubes, etc.**—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

**Phosphor Bronze.**—Strip, 13½d. per lb.; sheets to 10 w.g., 14½d.; wire, 16d.; rods, 16d.; tubes, 21½d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

**Nickel Silver, etc.**—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

## NON-FERROUS SCRAP

**Controlled Maximum Prices.**—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s., braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £74 10s., all per ton, ex works.

**Returned Process Scrap.**—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended July 24, where buyer and seller have not mutually agree a price; net, per ton, ex-sellers' works, suitably packed):—

BRASS.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled),£42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

CUPRO NICKEL.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

NICKEL SILVER.—Process and manufacturing scrap: 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

COPPER.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

## IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3¾ per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

**South Wales.**—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

**Middlesbrough.**—Short heavy steel, 79s. 9d. to 82s. 3d. heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

**Birmingham District.**—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

**Scotland.**—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(NOTE.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*

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## SITUATIONS VACANT AND WANTED

STEEL FOUNDRY MANAGER desires change, technical and practically trained Metallurgist and Foundryman; experienced control jobbing and mechanised; electric and convertor steel, planning, estimating and ratefixing.—Box 950, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY MANAGER required for Iron Foundry in S.W. London; able to fix piece work rates and take complete charge of the Foundry employing about 60. We would like enquires from men aged 34 to 37 for this post. Salary would commence at £800 per annum for the right type of man. When applying, please state age and previous experience. —Box 954, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WANTED, Siemens OPEN HEARTH SHIFT MANAGER, capable of taking charge of acid and basic furnaces manufacturing plain carbon and alloy steels with an output of 3,000 tons per week Experience of modern uphill casting pit practice is essential. Applicants should give particulars of their education, experience and age.—Reply to Box 952 FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MANAGER (qualified Metallurgist) required for metallurgical research section of large organisation in London district manufacturing aircraft and other scientific instruments.—State qualifications, experience, and salary required to Box 948, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

METALLURGIST or Foreman required to take charge of Tropenas Plant in small Steel Foundry; must be fully conversant with cupola and converter; steel castings mixtures subjected to Admiralty test and requirements; permanency.—Box 944, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

### EMPLOYMENT REGISTER.

*Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.*

FOUNDRY WORKS MANAGER; 17 years' executive experience, machine tools and internal combustion engines; estimating, costing and organisation; casting of mechanised plants; age 45. (449)

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## PATENT

EQUITY and PATENT No. 483380.—Improvements in the methods of casting non-ferrous metals or plastics in vacuum can be acquired.—MAYFAIR ADVERTISING LTD., 19, Stratford Place, London, W.1.

## MACHINERY

WANTED, TWO-WHEELED FOUNDRY BOGIE. Capacity about 15 cwts. Diameter of wheels 2 ft. 8 in. Centres 2 ft. 8 in.—ELLERBY FOUNDRY LTD., Leeds, 9.

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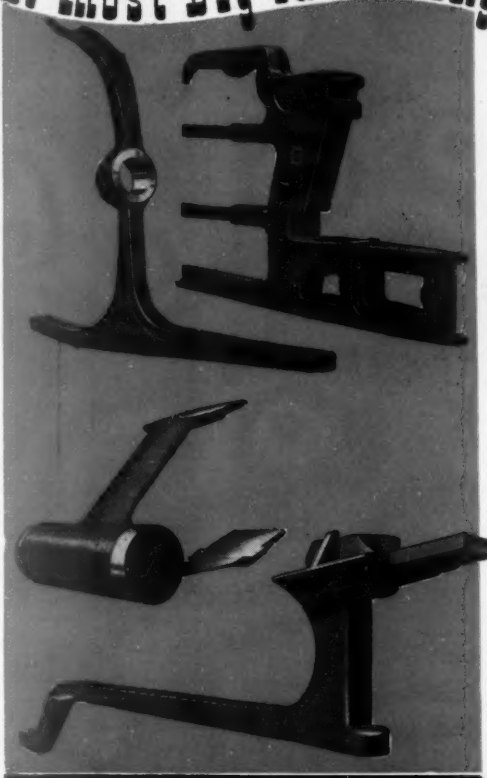

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